

Astronomy (Celestial Backgrounds)

The Cosmic UV Background

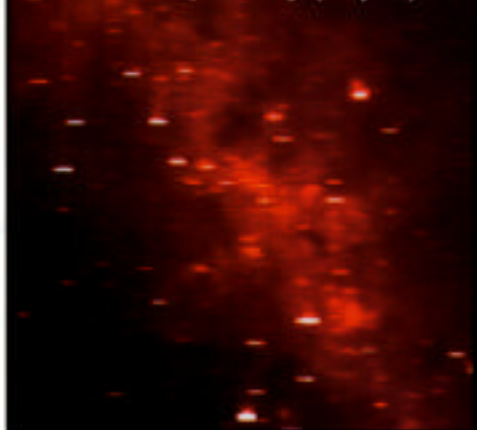
The ordinary matter that we observe in the universe is believed to be only about 2% of the amount needed to "close" the universe. The rest is the "missing mass," 90% of which did not participate in the chemistry of the first 3 minutes after the Big Bang. The nature of this purported "missing mass" is unknown, but one candidate is known to exist: neutrinos. We are bathed in neutrinos left over from the Big Bang in exactly the same way that we are bathed in the 3 K background radiation. Neutrinos were long believed to have zero rest mass and would therefore not contribute to closure of the universe. But there are recent suggestions that neutrinos may have a tiny rest mass. Photons emitted by decaying neutrinos would be observable in the ultraviolet—the range measured by the UVISI instruments on MSX. Because of its sensitivity and large sky coverage area, MSX provides the best chance of detecting, or placing a significant constraint on, this hypothesized radiation.

Brown Dwarfs and the Local Missing Mass

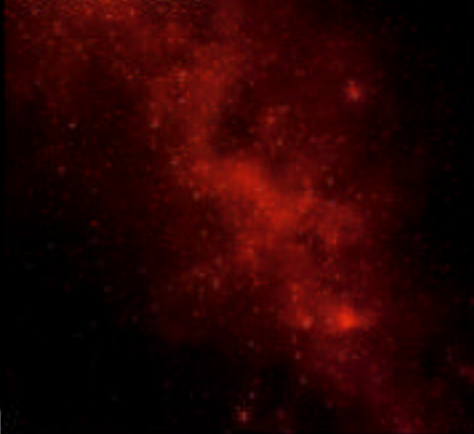
Brown dwarfs thus far exist only in the realm of theory. They are too large to be called planets, yet too small to trigger nuclear fusion in their cores as all true stars must. Brown dwarfs are considered to be good candidates for the baryonic "dark matter" that might make up half the mass of the Milky Way's disk and

as much as 98% of the universe. Theory predicts that these objects should have a mass between about 10 and 70 times that of the planet Jupiter, a temperature of around 1000 K, and, because of the low temperature, exhibit bands due to the presence of CO and H₂O. MSX has the sensitivity and wavelength range and will map a large enough volume of space to detect the pres-

Present Capability (12 μ m)



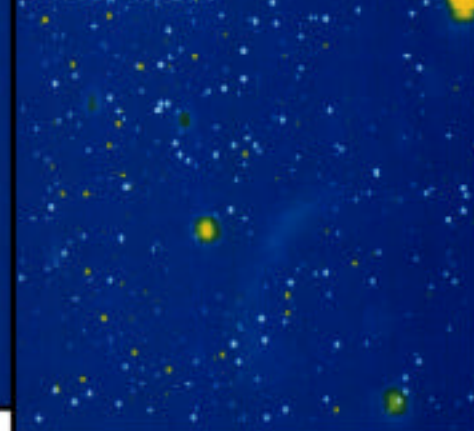
After MSX



Present Capability (0.14 μ m)



After MSX



ence of nearby brown dwarfs or place a meaningful limit on their local number density.

Structure of the Milky Way Galaxy

Is the Milky Way Galaxy a barred spiral or a more symmetric spiral like the Andromeda galaxy? Direct optical observations of the inner regions of the Milky Way are not possible because of absorption and scattering of starlight by interstellar dust in the galactic plane. At radio wavelengths, only clouds of gas, primarily hydrogen, and dense dust clouds are observable. But the dust is 10 times more transparent in the infrared wavelength range spanned by the SPIRIT III radiometer. This spectral region also contains the brightest beacons in the galaxy, easily detectable by MSX to the center of the Milky Way. To date, the resolution of

infrared mapping instruments has been too low to permit observation of individual stars in crowded regions. MSX with 30 times higher spatial resolution than the best previous space infrared survey telescope — will be able to discern the true nature of structure in the inner galaxy.

Interstellar Smog?

One of the major surprises of the last decade is that infrared emission from interstellar dust is some five to seven orders of magnitude greater than anticipated from the very cold environs of this dust. Spectral observations of emission and reflection nebulae show strong infrared emissions from hydrocarbons. It is suggested that these smog-like hydrocarbons permeate interstellar dust, but direct measurements are difficult because of the low surface brightness of the emission. The SPIRIT III

interferometer is the first instrument capable of detecting the low surface brightness signatures from hydrocarbons.

Recent Asteroid Collisions

The extinction of the dinosaurs isn't the only known consequence of asteroid collisions. The dust bands circling the Sun were created by the collisional breakup of moderately large asteroids tens of kilometers in size. Several such collisions have occurred in the last billion or so years to produce the bands that have been observed. MSX has the sensitivity and spatial resolution to observe fainter and narrower bands that would be characteristic of more recent collisions or the disruption of smaller asteroids.

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